

Taxonomy on Freshwater Canthocamptid Harpacticoids from Korea III. Genera *Mesochra* and *Elaphoidella*

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ABSTRACT

Genera *Mesochra* and *Elaphoidella* have been studied as one of the serial studies on the taxonomy of the family Canthocamptidae in South Korea. As a result of it, two species of *Mesochra* and three species of *Elaphoidella* are added to Korean fauna: *M. alaskana* Wilson, *M. suifunensis* Borutskii, *E. grandidieri* (Guerne and Richard), *E. bidens* (Schmeil) and *E. superpedalis* Shen and Tai. A key to the species of the genera *Mesochra* and *Elaphoidella* known from Korea is prepared.

Key words: taxonomy, *Mesochra*, *Elaphoidella*, Canthocamptidae, Harpacticoida, freshwater Copepoda, Korea

INTRODUCTION

As the third report on the taxonomy of the family Canthocamptidae in South Korea, this paper deals with the genera *Mesochra* and *Elaphoidella*. Comparing with *Canthocamptus* and *Attheyella* harpacticoids dealt in the previous papers (Chang and Lee, 2003a, b), which are mostly mountainous copepods, *Mesochra* and *Elaphoidella* harpacticoids are usually found from the stagnant waters in the plains or among the plant materials of streamside. Total five species belonging to the genera *Mesochra* and *Elaphoidella* are taxonomically accounted here: *M. alaskana* Wilson, *M. suifunensis* Borutskii, *E. grandidieri* (Guerne and Richard), *E. bidens*

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(Schmeil) and *E. superpedalis* Shen and Tai. All of them are newly reported from Korea.

MATERIALS AND METHODS

Materials were taken from the freshwater harpacticoid collection stocked in the Department of Biology, Daegu University, which has been obtained from the various freshwater bodies at over 120 localities in South Korea since March, 1985.

Samplings were made with a dipnet of no. 10 mesh aperture, and copepods were fixed and stored in 4% buffered formalin. All the specimens were dissected, drawn, and measured in lactophenol on H-S slide, a recent modification of Cobb slide. Mounted specimens were observed under a differential interference contrast microscope with Nomarski optics. Figures were prepared with the aid of a camera lucida.

Abbreviations are used in the text and figure legend: enp 1-3 or exp 1-3, the first to third endopodal or exopodal segment of each leg; L/W, length to width ratio.

SYSTEMATIC ACCOUNTS

Family Canthocamptidae Sars, 1906

Genus **Mesochra* Boeck, 1864

1. ***Mesochra alaskana* Wilson, 1958 (Fig. 1)

Mesochra alaskana Wilson, 1958, p. 47; Ishida, 1987, p. 81, pl. 6; Ishida and Kikuchi, 2000, p. 19, fig. 18.

Material examined. Three ♀♀, 1♂, Yeongogcheon Stream (estuary) (Sacheon, Gangreung) 2 Jun. 1990 (C. Y. Chang); 2♀♀, 1♂, Wangpicheon Stream (estuary) (Uljin) 7 May 1993 (C. Y. Chang); 3♀♀, 5♂♂, Mangyangjeong (swamp) (Uljin) 7 May 1993 (C. Y. Chang); 2♀♀, 1♂, Jangsacheon (estuary) (Yeongdeok) 13 Apr. 1996 (C. Y. Chang); 8♀♀, 5♂♂, Jangsacheon Stream (estuary) (Yeongdeok) 21 May 1999 (C. Y. Chang); 4♀♀, 2♂♂, Jangsacheon Stream (estuary) (Yeongdeok) 27 Feb. 2003 (H. S. Rho, J. M. Jeon and K. H. Ahn).

Diagnosis. Body (Fig. 1A) sparsely haired on dorsal surfaces of cephalosome and thoracic somites, small and cylindrical, 0.43-0.51 mm long in females and 0.39-0.46 mm in males, excluding rostrum and caudal setae; usually tinged with pale yellow in alcohol or formalin; all thoracic and abdominal somites except anal somite with relatively smooth posterior margin; anal operculum a little convex with 5-6 fine spinules along posterior margin (Fig. 1B); a few spines on each ventromedial corner of anal somite not shown apparently in a dorsal view; caudal rami of both sexes (Fig. 1B) truncate, narrowing posteriorly, a little wider than long (L/W about 0.9) in female, with a spinule array along distomedial corner; dorsal seta located medially; rostrum huge and pointing downward; antennule (Fig. 1A) 7-segmented; exopod of antenna 1-segmented, bearing 3 setae; leg 1 enp 1 (Fig. 1C) a little longer than whole exopod; female legs 2-4 (Fig. 1D-

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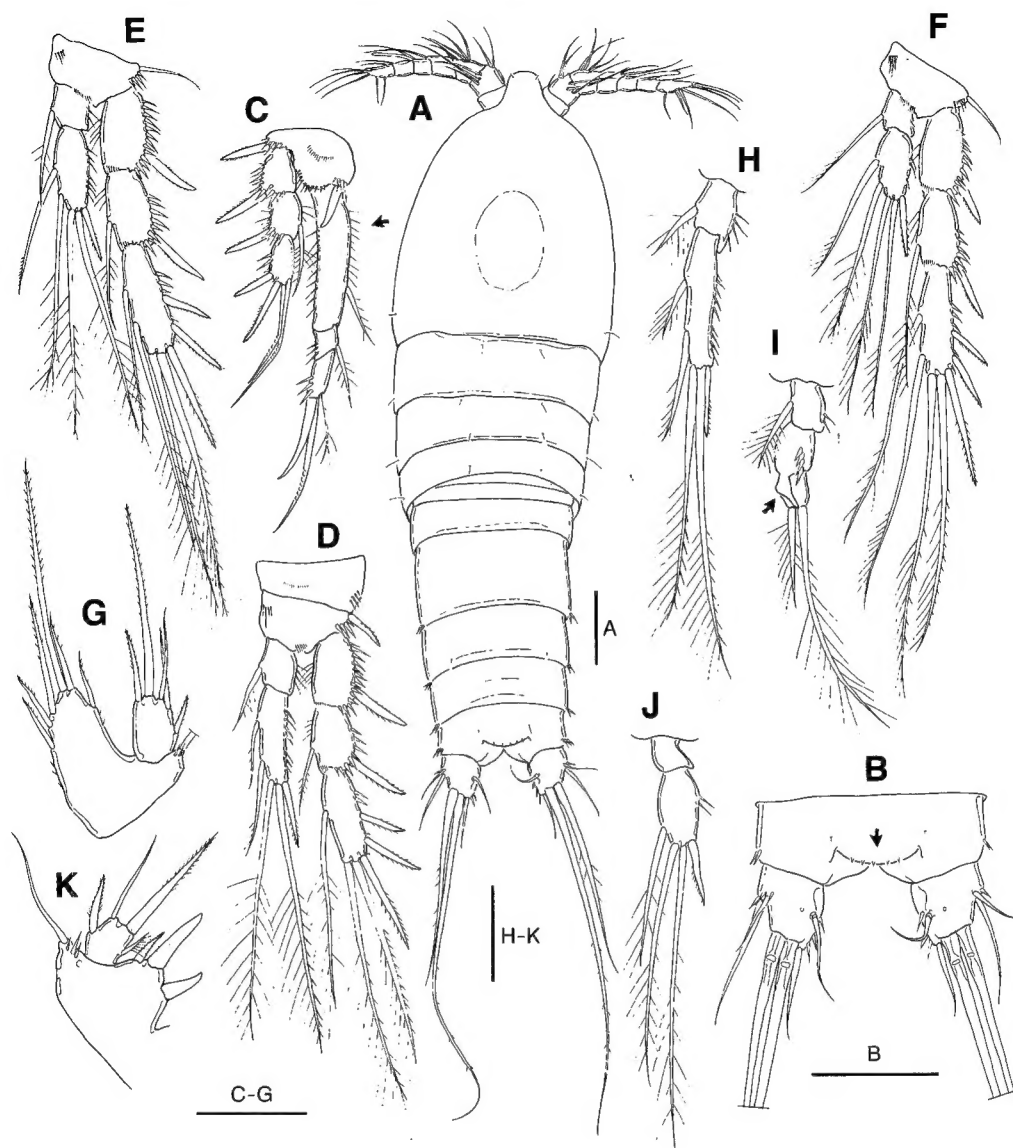


Fig. 1. *Mesochra alaskana*, female. A, habitus, dorsal; B, anal somite and caudal rami, dorsal; C-G, legs 1-5. Male: H-J, endopods of legs 2-4; K, leg 5. Scale bars = 0.03 mm (H-K), 0.05 mm (A-G).

F) with typical pattern of *Mesochra*; female leg 5 (Fig. 1G) exopod nearly rectangular (L/W about 1.2-1.3), furnished with 5 setae in total; baseoendopod much exceeding distal end of exopod, equipped with 6 spiniform setae, midst one longest; male leg 2 enp 2 (Fig. 1H) bearing 2 medial and 2 apical setae with spinule row along lateral margin; male leg 3 enp 2 (Fig. 1I) strongly modified, armed with 4-5 spinules near distolateral corner and a remnant of apophysis in distomedial corner; enp 3 with 2 apical setae; male leg 4 (Fig. 1J) enp 1 without medial seta, enp 2 with 3 slender plumose setae and 1 spine; male leg 5 (Fig. 1K) baseoendopod with 3 spines, midst

one longest and stout; exopod with 4 setae in total including 1 small medial seta.

Remarks. Korean specimens of *M. alaskana* fitted perfectly with the Japanese specimens (Ishida and Kikuchi, 2000). In Japan, *M. rapiens* (Schmeil), a closely related species with the present species, is also known and once co-occurred with it in a lake of Aomori-ken, Honshu (Ishida and Kikuchi, 2000). *Mesochra alaskana* is distinguished from *M. rapiens* in having the much longer leg 1 enp 1 than exopod and the anal operculum with fine spinules. In China, this species has not been known still yet.

The present species occurred from the mouths of streams draining into the East Sea (Sea of Japan) in Korea, and frequently co-occurred with *Harpacticella itoi* Chang and Kim, 1991.

Distribution. North America (Alaska, Ontario), Japan, Korea.

2. **Mesochra suifunensis* Borutskii, 1952 (Fig. 2)

Mesochra suifunensis Borutskii, 1952, p. 148, figs. 52-53; Tai and Song, 1979, p. 207, fig. 109.

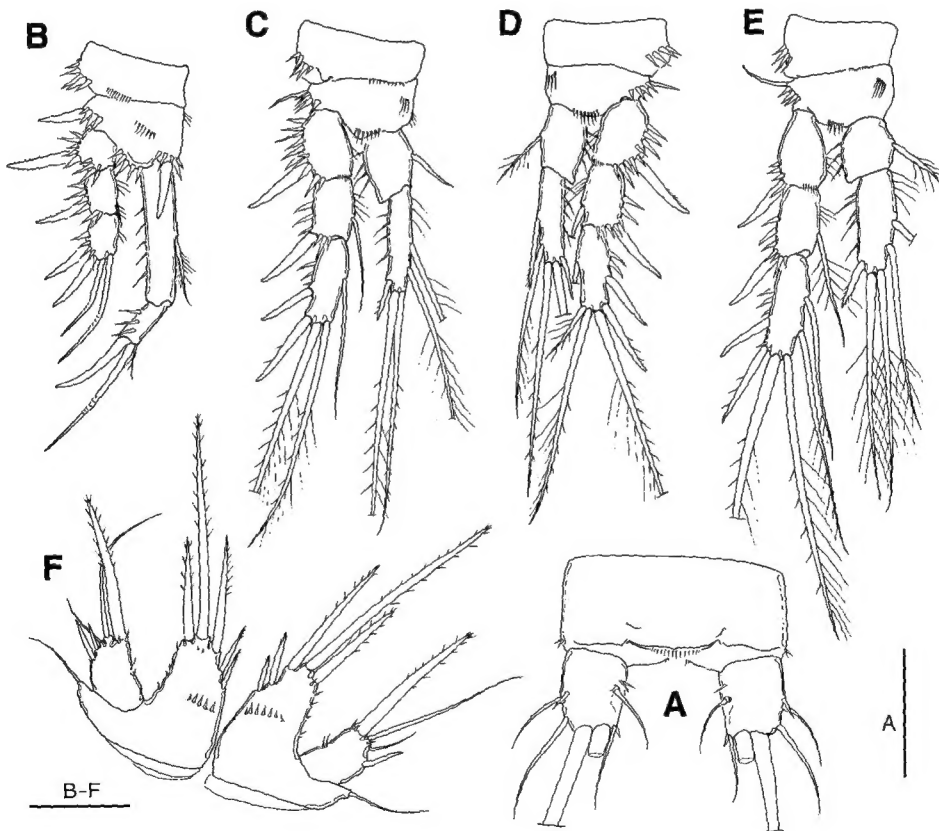


Fig. 2. *Mesochra suifunensis*, female. A, anal somite and caudal rami, dorsal; B-F, legs 1-5. Scale bars = 0.03 mm.

Material examined. One ♀ (ovi.), Daechongho Lake (Daejeon) 15 Sep. 2001 (C. Y. Chang and J. M. Lee).

Diagnosis. Body similar to the preceding species, usually tinged with pale gray, tiny, 0.48 mm long in the female specimen examined, excluding rostrum and caudal setae; anal operculum (Fig. 2A, arrow) a little convex with fine setules on its posterior margin; caudal rami (Fig. 2A) nearly rectangular (L/W about 0.9–1.1) and a little divergent, with straight medial margin; female antennule 6-segmented with a long aesthetasc on third segment; antennal exopod 1-segmented with 3 apical setae; leg 1 endopod 2-segmented, enp 1 a little longer than exopod with a seta near the middle of medial margin (Fig. 2B), enp 2 with 1 stout lateral spine, 1 medial geniculate seta and a short seta; legs 2–4 (Fig. 2C–E) with typical pattern of *Mesochra*, legs 2–4 enp 1 each bearing a slender medial seta; female leg 5 (Fig. 3G) baseoendopod protruding and reaching the distal end of exopod, bearing 6 spiniform setae; exopod L/W about 1.9–2.5, with 5 apical setae; male leg 2 enp 2 (Fig. 4A) bearing 2 apical setae with spinules along lateral margin; male leg 3 enp 2 (Fig. 4B) armed with a barbed process (apophysis), enp 3 with 2 slender apical setae, exp 1–2 each armed with a huge and thickened spine on distolateral corner, spine on exp 2 much exceeding beyond exp 3; male leg 4 enp 2 (Fig. 4C) with 2 short apical setae and 1 stout medial spine; male leg 5 (Fig. 3I) baseoendopod with 2 spiniform setae, medial one of which about 1.7 times longer than lateral one; exopod rather suboval, L/W about 1.3–1.6, bearing 4 spiniform setae.

Remarks. *Mesochra suifunensis* is known to be collected often from the estuarine brackish waters or sometimes from the freshwaters (Tai and Song, 1979). Korean specimen was found in the bottom about 45 m deep at Daechong Lake situated in the middle of South Korea.

Korean specimen was well coincided with the original description (Borutskii, 1952) except for the presence of 1 spine and 2 setae on leg 1 enp 2, and a slender medial seta on legs 2–4 enp 1, which were observed in the Chinese specimens (cf. Tai and Song, 1979: 209). Furthermore, Korean specimen showed the asymmetry in the ornamentation of female leg 5 exopod, that is, four setae in one exopod (as in the types and Chinese specimens) while five in the other exopod (Fig. 2F).

Distribution. Far East Russia (Suifen Ho River), China, Korea.

A key to the species of genus *Mesochra* from Korea

- Leg 1 endopod 3-segmented; antennule 7-segmented; female leg 5 baseoendopod bearing 6 setae
 *M. alaskana* Wilson
- Leg 1 endopod 2-segmented; antennule 6-segmented; female leg 5 baseoendopod bearing 4 setae
 *M. suifunensis* Borutskii

Family Canthocamptidae Sars, 1906 딱정장수노벌레과

Genus *Elaphoidella* Chappuis, 1928 사슴노벌레속 (신칭)

3. **Elaphoidella grandidieri* (Guerne and Richard, 1893) (Figs. 3, 4)

Canthocamptus grandidieri Guerne and Richard, 1893, p. 234, figs. 1–9; Douwe, 1907, p. 363.

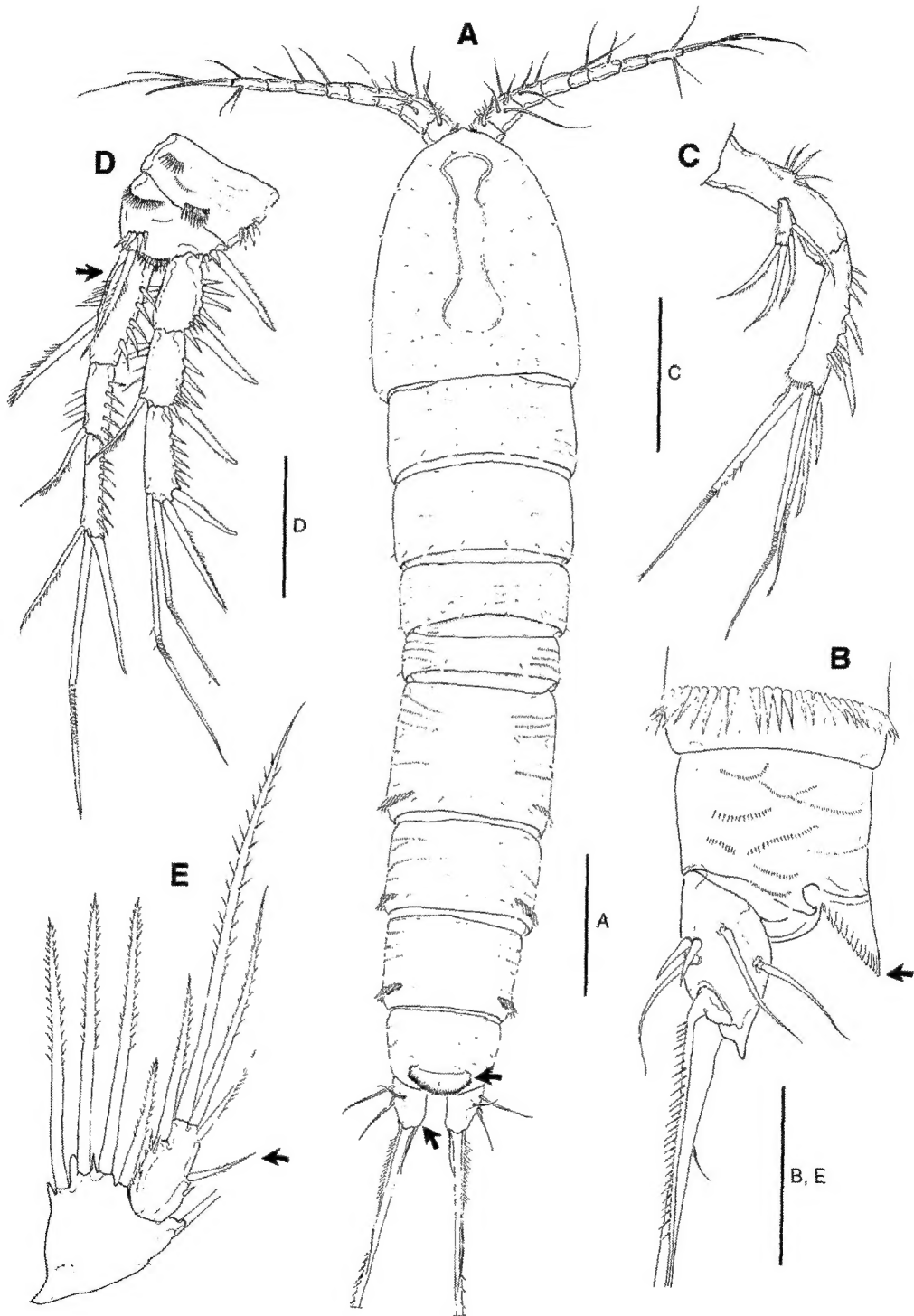


Fig. 3. *Elapholidella grandidieri*, female. A, habitus, dorsal; B, anal somite and caudal rami, lateral; C, antenna; D, leg 1; E, leg 5. Scale bars = 0.05 mm (B-E), 0.1 mm (A).

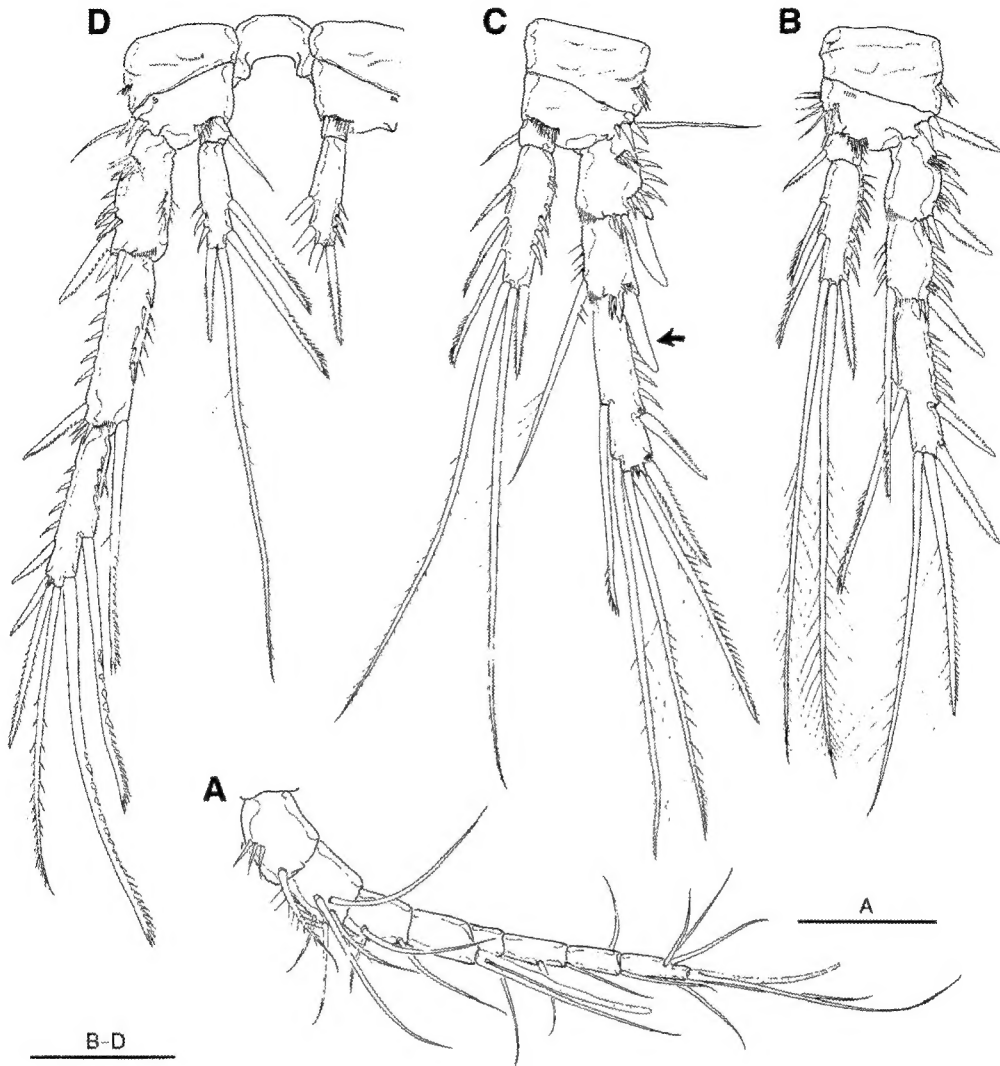


Fig. 4. *Elaphoidella grandidieri*, female. A, antennule; B-D, legs 2-4. Scale bars = 0.05 mm.

Attheyella grandidieri Sars, 1904, p. 639, pl. 37.

Elaphoidella grandidieri Chappuis, 1928, p. 49; Lang, 1948, p. 1136; Borutskii, 1952, p. 293, fig. 81 (15-17); Tai and Song, 1979, p. 248, figs. 137-138; Kikuchi, 1985, p. 1; Ishida and Kikuchi, 2000, p. 25, fig. 31.

Material examined. One ♀, Dugyecheon Stream (Nonsan) 15 Jul. 2003 (C. Y. Chang, J. M. Lee, J. M. Jeon and K. H. Ahn); 2 ♀♀, Geumho River (Hayang, Gyeongsan) 13 Jul. 1991 (C. Y. Chang); 3 ♀♀, Jeongyangji Reservoir (Hapcheon) 19 Feb. 2002 (C. Y. Chang and J. M. Lee); 5 ♀♀ (3 ovi.), Jeongyangji Reservoir (Hapcheon) 19 Feb. 2002 (C. Y. Chang, J. M. Lee, J. M. Jeon and E. H. Kwon); 3 ♀♀ (2 ovi.), Jilnalnup Swamp (Haman) 10 Jun. 2002 (J. M. Lee and J. M. Jeon).

Diagnosis. Body cylindrical and moderately big, 0.75–0.85 mm long in females, excluding rostrum and caudal setae; anal operculum (Fig. 3A, B, arrow) with well-developed hyaline protrusion much exceeding over dorsal setae on caudal rami in a lateral view; caudal rami truncate, a little elongate (L/W about 1.3–1.5) and a little narrowing posteriorly, with smooth medial surface (Fig. 3A, arrow); antennule (Fig. 4A) 8-segmented; exopod of antenna (Fig. 3C) 1-segmented with 4 setae in total; leg 1 enp 1 (Fig. 3D, arrow) short, not reaching distal end of exp 2; leg 2 enp 2 (Fig. 4B) bearing 2 short medial, 2 long apical setae and 1 spine with spinules along lateral margin; leg 3 exp 2 armed with thickened posterolateral spine (Fig. 4C, arrow), enp 2 enlarged with 3 medial setae; leg 4 enp 1 usually with 1 medial seta, but rarely lacking (Fig. 4D), exp 3 with 2 modified medial setae; leg 5 (Fig. 3E), baseoendopod not protruding with 4 setae, exopod about 1.5 times longer than wide with 5 setae in total, lateral one of which short (arrow).

Remarks. *Elaphoidella grandidieri* is characteristic in having the well-developed hyaline membrane on anal operculum (Fig. 3A, B, arrow). This species is supposed to be parthenogenetic, a common phenomenon in *Elaphoidella*, and therefore has shown the worldwide distribution (Borutskii, 1952; Ishida and Kikuchi, 2000).

Korean specimens were well coincided with the original description, and the detailed redescription of Kikuchi (1985). In Korea, this species seems to prefer the plant-rich riverside or lowland swamps, as a polycyclic warm-water form developing in summer.

Distribution. Africa, Asia (India, Thailand, Vietnam, Indonesia, China, Japan and South Korea), Central and South America.

4. **Elaphoidella bidens* (Schmeil, 1894) (Fig. 5)

Canthocamptus bidens Schmeil, 1894, p. 73.

Elaphoidella bidens: Chappuis, 1928, p. 49; Borutskii, 1952, p. 294, fig. 81 (13–14); Dussart, 1967, p. 374, fig. 160; Ishida, 1990, p. 40; Ishida, 1987, p. 87, pl. 28; Ishida and Kikuchi, 2000, p. 24, fig. 30.

Elaphoidella coronata: Tai and Song, 1979, p. 251, fig. 139.

Elaphoidella decorata: Tai and Song, 1979, p. 253, fig. 240.

Materials examined. Three ♀♀, Mihocheon Stream (Jincheon) 15 Oct. 1999 (C. Y. Chang, J. M. Lee and H. S. Ahn); 3 ♀♀, Daejeon, 16 Jul. 1990 (C. Y. Chang and S. J. Song); 3 ♀♀, Gaetaesa Temple (spring) (Nonsan) 14 Sep. 1999 (C. Y. Chang); 6 ♀♀, Weolsongjeong (swamp) 8 Oct. 1999 (J. M. Lee and Y. H. Song); 1 ♀, Nakdong R. (Andong) 29 Jul. 1999 (J. M. Lee and Y. H. Song); 6 ♀♀, Mangyeong R. (Gimje) 3 Jun. 2000 (C. Y. Chang and J. M. Lee); 12 ♀♀, Okgyeseoweon (swamp) (Angang) 1 Oct. 1999 (C. Y. Chang, J. M. Lee and Y. H. Song); 1 ♀, Magonup (Changnyeong) 24 Aug. 1993 (C. Y. Chang); 1 ♀, Seomjin River (Gurye) 20 May 1995 (H. S. Rho); 3 ♀♀, Silla Univ. (pond) (Busan) 29 Oct. 1995 (S. J. Song and J. M. Lee); 2 ♀♀, Nakdong River, 29 Jul. 1999 (C. Y. Chang, J. M. Lee and Y. H. Song); 1 ♀, Myeongsa (swamp) (Geoje) 18 Aug. 1987 (H. S. Kim and C. Y. Chang).

Diagnosis. Body cylindrical and rather small, 0.52–0.56 mm long, excluding rostrum and caudal setae; anal operculum gently convex, with 12–14 spinules on its posterior margin (Fig. 5A, arrow),

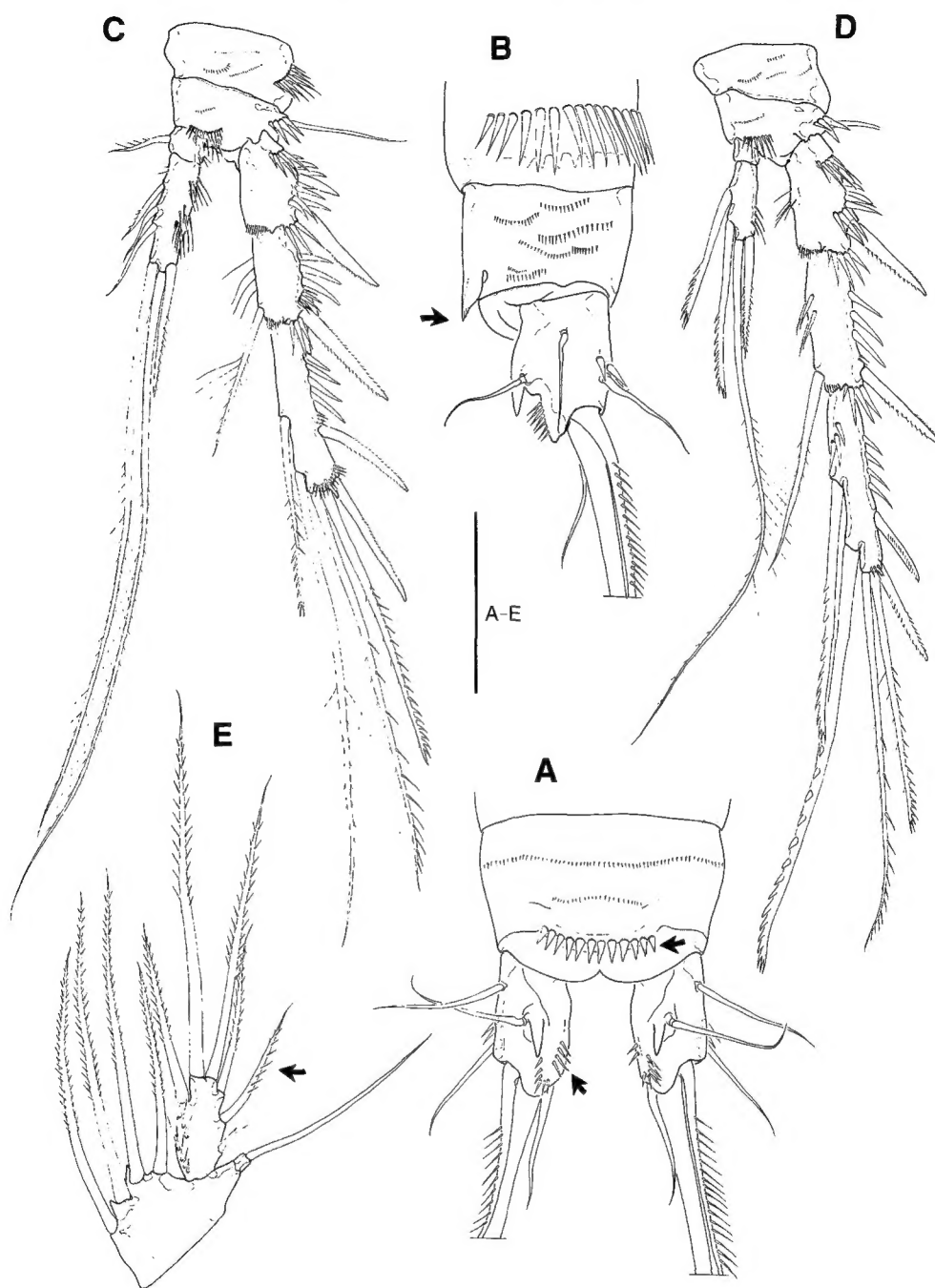


Fig. 5. *Elapholidella bidens*, female. A, anal somite and caudal rami, dorsal; B, anal somite and caudal rami, lateral; C-E, legs 3-5. Scale bar = 0.05 mm.

far from the level of dorsal seta on caudal rami in a lateral view (Fig. 5B, arrow); caudal rami cylindrical, elongate (L/W about 1.3-1.5), with blunt posteromedial protrusion and setule array on

distomedial surface (Fig. 5A, arrow); antennule 8-segmented; exopod of antenna 1-segmented with 4 setae in total; leg 1 enp 1 short, not reaching distal end of exp 2; leg 2 enp 2 bearing 2 short medial, 2 long apical setae and 1 spine with spinules along lateral margin; posterolateral spine on leg 3 exp 2 not so thickened (Fig. 5C, arrow) as in the preceding species; leg 4 exp 3 with 2 modified medial seta (Fig. 5D); leg 5 (Fig. 5E), baseoendopod not protruding, with 4 setae, exopod about 1.5-1.8 times longer than wide with 5 setae in total, lateral one not so small as in the preceding species.

Remarks. As *Elaphoidella grandidieri*, this species is also supposed to be parthenogenetic, and showing the cosmopolitan distribution through the various forms (Borutskii, 1952; Ishida and Kikuchi, 2000). Especially, two forms of *E. bidens*, *decorata* and *coronata*, have been recorded as the subspecies of this species, or as the distinct species in the numerous references (see Dussart and Defaye, 1990). The major criterion of the classification of the two 'forms' is the presence or not of the medial seta of leg 4 endopod (Tai and Song, 1979).

In Korea, this species is frequently occurred from the eutrophicated swamps, reservoirs, and temporary pools in the lowlands, particularly in the time of high water temperature.

Distribution. Cosmopolitan.

5. **Elaphoidella superpedalis* Shen and Tai, 1964 (Figs. 6, 7)

Elaphoidella superpedalis Shen and Tai, 1964, p. 381, figs. 61-63; Tai and Song, 1979, p. 255, fig. 142; Ishida and Kikuchi, 2000, p. 25, fig. 32.

Material examined. Two ♀♀, Oksanseowon (swamp) (Angang, Gyeongju) 1 Oct. 1999 (C. Y. Chang, J. M. Lee, and H. S. Ahn).

Diagnosis. Body cylindrical and prosome relatively wide, 0.56-0.58 mm long in females, excluding rostrum and caudal setae; anal operculum (Fig. 6A, arrow) with well-developed hyaline protrusion a little not reaching level of dorsal setae on caudal rami; anal somite with 2-3 spinules on lateral side (Fig. 6B, arrow); caudal rami truncate, elongate (L/W about 1.8-2.0) and a little narrowing posteriorly, with smooth medial surface; leg 1 enp 1 (Fig. 6C) short, reaching distal end of exp 2, bearing 1 strongly modified seta on distal third of medial margin of enp 1; leg 2 (Fig. 7A) enp 2 bearing 1 short and 1 modified medial setae, 2 long apical setae and 1 short spine, and exp 2 and exp 3 each bearing 1 modified medial seta, respectively; leg 3 enp 2 a little swollen with 3 medial setae, and exp 2 armed with normal posterolateral spine (Fig. 7B, arrow); leg 4 (Fig. 7C) exopod remarkably elongate with much shortened distolateral spines, especially in exp 2 and exp 3; leg 5 baseoendopod not protruding with 4 setae, and exopod (Fig. 6D, arrowed) strikingly elongate, about 4.1-4.3 times longer than wide with 5 setae in total, apical one of which longest (1.6-1.7 times longer than exopod).

Remarks. This species is much similar to *E. grandidieri*, especially in having the well-developed hyaline protrusion on anal operculum, but characteristic in having the elongate leg 5 exopod as shown in the specific name. Ishida and Kikuchi (2000) suggested that this species apparently showed the dioecious reproduction, considering the relatively high rate of male individuals and the spermatophore formation in Japan, in contrast with the two preceding parthenogenetic species.

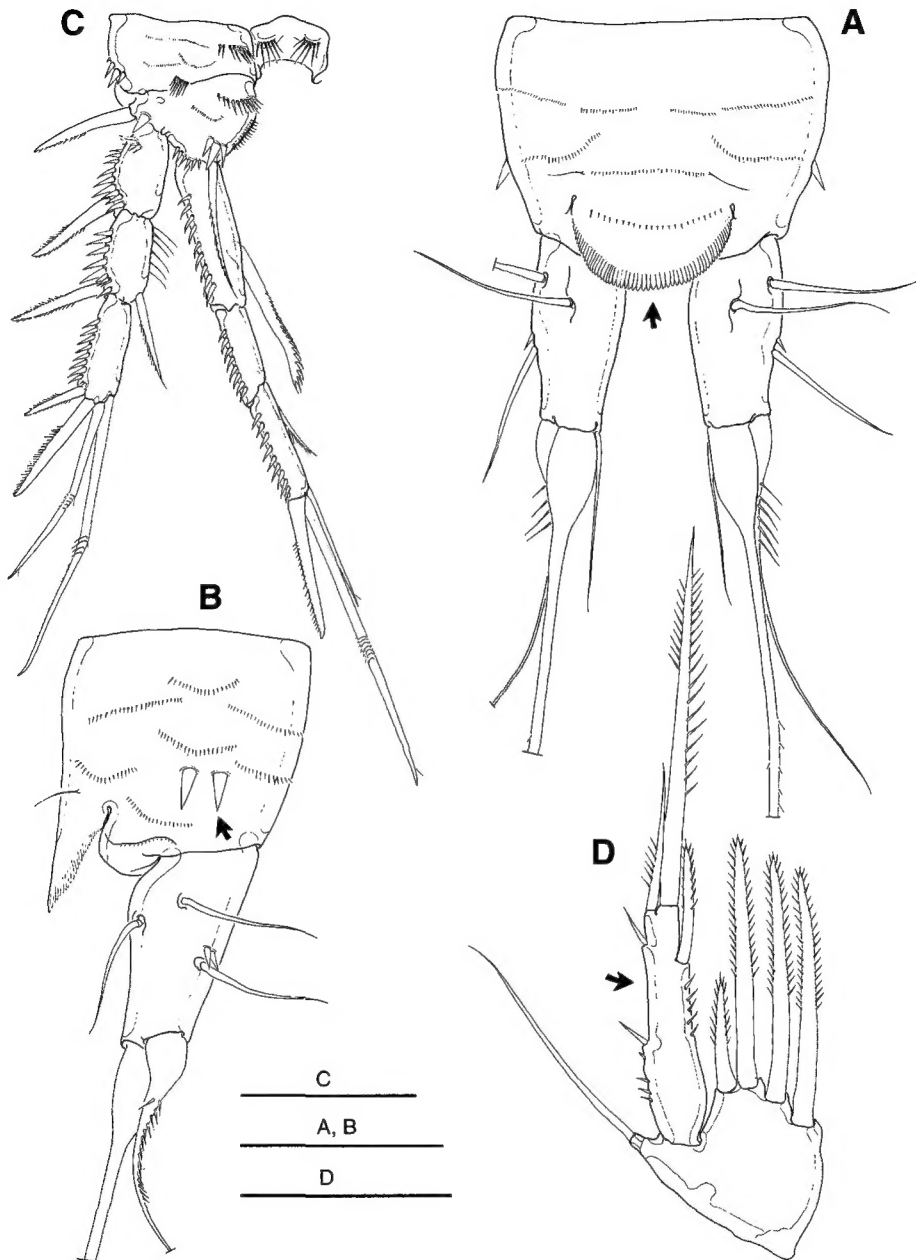


Fig. 6. *Elaphoidella superpedalis*, female. A, anal somite and caudal rami, dorsal; B, anal somite and caudal rami, lateral; C, leg 1; D, leg 5. Scale bars = 0.05 mm.

Korean specimens fitted well with the original description (Shen and Tai, 1964), and the Japanese specimens (Ishida and Kikuchi, 2000), except the terminal and lateral caudal setae swollen basally, however, the character state is sometimes observed in the freshwater harpacticoid taxa like genus *Canthocamptus* and generally regarded as the geographical variation.

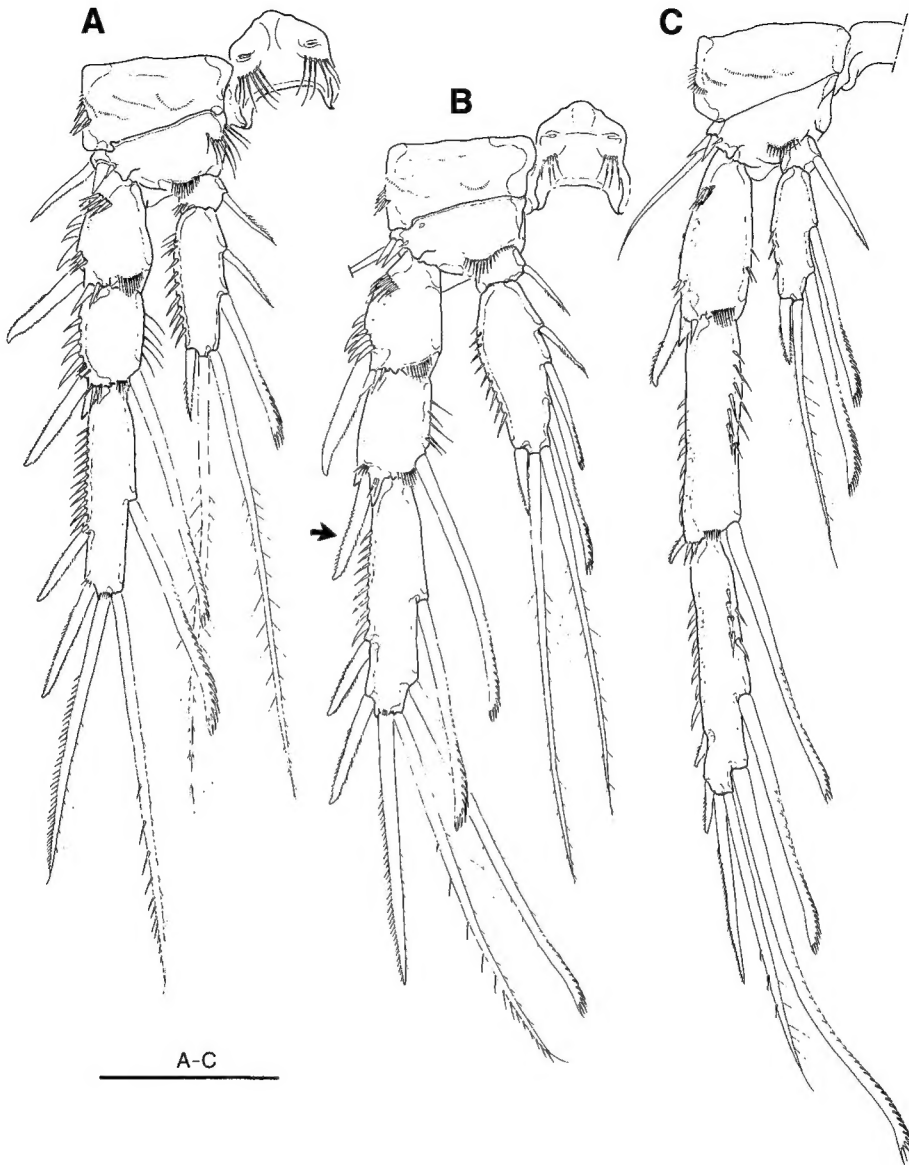


Fig. 7. *Elaphoidella superpedalis*, female. A-C, legs 2-4. Scale bar = 0.05 mm.

In Korea, this species was found in a lowland swamp, co-occurring with *E. grandidieri* and *Megacyclops viridis*, *Eucyclops roseus*, and a polysaprobic gastrotrich species *Polymerurus longicaudus*.

Distribution. China (Kwangtung), Japan (Hokkaido) and South Korea.

A key to the species of genus *Elaphoidella* from Korea

1. Leg 5 exopod much elongated *E. superpedalis* Shen and Tai

- Leg 5 exopod not elongated (less than 2 times longer than wide) 2
2. Hyaline membrane of anal operculum far exceeding the dorsal seta in a lateral view; distomedial face of caudal rami smooth without spinules *E. grandidieri* (Guerne and Richard)
- Hyaline membrane of anal operculum not reaching the dorsal seta in a lateral view; distomedial face of caudal rami with spinules *E. bidens* (Schmeil)

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한국 담수산 딱정장수노벌레과 갈고리노벌레류의 분류 III. 큰빨장수노벌레속 (*Mesochra*)과 사슴노벌레속 (*Elaphoidella*)

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요 약

한국 담수산 딱정장수노벌레과 (Canthocamptidae)의 요각류에 대한 분류학적 연구의 일환으로, 큰빨장수노벌레속 2종 (*Mesochra alaskana*, *M. suifunensis*) 과 사슴노벌레속 3종 (*Elaphoidella grandidieri*, *E. bidens*, *E. superpedalis*)을 보고한다. 이들은 모두 한국에서는 처음으로 보고되는 종이다. 현재까지 한국에서 기록된 큰빨장수노벌레속과 사슴노벌레속의 종 검색표를 작성하였다.